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EXAMINER	
NOGUEROLA, ALEXANDER STEPHAN	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

mailroom@bskb.com

Office Action Summary	Application No. 10/517,835	Applicant(s) EIDSNES ET AL.	
	Examiner ALEX NOGUEROLA	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 September 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *32-73* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *32-73* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 December 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/25/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment of September 02, 2008 ("Amendment") does not render the application allowable.

Response to Arguments

2. Applicant's arguments filed September 02, 2008 have been fully considered but they are not persuasive. Applicant asserts, "Instead Squires is concerned with microfluidic pumps and mixers driven by induced-charge electroosmosis …This is fundamentally different from the present invention which provides a microchannel and a pump arranged to cause fluid in the microchannel to flow under the action of secondary electroosmosis." See page 10 of the Amendment. Yet Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196), which was provided by Applicant in their last Information Disclosure Statement, states

> The main difference between usual electrokinetic phenomena (i.e., electrokinetic phenomena of the first kind) and those of the second kind is that in the former the permanent surface charge is responsible<u>, whereas in the latter [secondary electroosmosis] it is bulk charge, induced by the applied field itself</u>. [emphasis added] *See the top of page 174.*

That is, according to Dukhin induced-charge electroosmosis is secondary electrosmosis. An article by Bazant[1] appears to suggest that secondary electroosmosis is a special type of induced-charge electroosmosis. Note especially "A super-limiting current causes the formation of extended space charge, which can alter the nature of ICEO flow.[emphasis added]" See the section entitled *Electrokinetic phenomena of the second kind* in the Bazant article.

Second, secondary electrosmosis and induced-charge electroosmosis are not incompatible. Applicant's own specification states, "Classical electroosmosis (EO1) is caused by transport of permanent charges (ions) in the EDL ... It is important that the SCR is established independently of the presence of any EDL on the surface." See page 18 of the specification. So, induced charge electroomosis may be accompanied by secondary electroosmsosis.

Last, claims 32-68 are apparatus claims. That Applicant's apparatus (microfluidic system) is used to create flow under the action of secondary electrosmosis is an intended use of which the apparatus of Squires is capable. The necessary structure for the microfluidic system appears to be only conducting elements projecting into the microchannel and a power supply to create an electrical field across the conducting elements. See "The conditions for obtaining EO2 can be summarized:" on page 20 of Applicant's specification. There is a strong similarity, for example, between Applicant's Figures 8-11 and Squires Figures 7, 9, 10, 12, and 13.

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[1] Nonlinear electrokinetic phenomena, M. Z. Bazant, in Li, Dongqing (ed), *Encyclopedia of Microfluidics and Nanofluidics*, Part 14, pp. 1461-1470 (Springer, Berlin, Heidelberg, New York, 2008). Downloaded from www.stanford.edu/group/bazant/papers on December 09, 2008.

Claim Rejections - 35 USC § 102

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 32, 33, 69, and 70-73 are rejected under 35 U.S.C. 102(b) as being anticipated by Squires, ("Microfluidic Pumps and Mixers Driven by Induced-Charge Electro-osmosis") as evidenced by Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196) and Bazant (Nonlinear electrokinetic phenomena, M. Z. Bazant, in Li, Dongqing (ed), *Encyclopedia of Microfluidics and Nanofluidics*, Part 14, pp. 1461-1470 (Springer, Berlin, Heidelberg, New York, 2008), downloaded from www.stanford.edu/group/bazant/papers on December 09, 2008).

Addressing claim 32, Squires discloses a microfluidic system comprising a microchannel and a pump arranged to cause fluid to flow under the action of electroosmosis. See the title and Figures 7, 9, 10, 12, and 13. Squires does not mention whether "secondary" electrosmosis is produced. However, this limitation is anticipated because, first, Dukhin (Advances in Colloid and Interface Science 85 (1991)

173-196), which was provided by Applicant in their last Information Disclosure Statement, states

> The main difference between usual electrokinetic phenomena (i.e., electrokinetic phenomena of the first kind) and those of the second kind is that in the former the permanent surface charge is responsible, whereas in the latter [secondary electroosmosis] it is bulk charge, induced by the applied field itself. [emphasis added] *See the top of page 174.*

That is, according to Dukhin induced-charge electroosmosis is secondary electrosmosis. Similarly, an article by Bazant appears to suggest that secondary electroosmosis is a special type of induced-charge electroosmosis. Note especially "A super-limiting current causes the formation of extended *space charge*, which can alter the nature of ICEO flow.[emphasis added]" See the section entitled *Electrokinetic phenomena of the second kind* in the Bazant article.

Second, secondary electrosmosis and induced-charge electroosmosis are not incompatible. Applicant's own specification states, "Classical electroosmosis (EO1) is caused by transport of permanent charges (ions) in the EDL ... It is important that the SCR is established independently of the presence of any EDL on the surface." See page 18 of the specification. So, induced charge electroosmosis may be accompanied by secondary electroosmosis.

Last, claim 32 is an apparatus claim. That Applicant's apparatus (microfluidic system) is used to create flow under the action of secondary electrosmosis is an intended use of which the apparatus of Squires is capable. The necessary structure for the microfluidic system appears to be only conducting elements projecting into the microchannel and a power supply to create an electrical field across the conducting

elements. See “The conditions for obtaining EO2 can be summarized:” on page 20 of Applicant’s specification. There is a strong similarity, for example, between Applicant’s Figures 8-11 and Squires Figures 7, 9, 10, 12, and 13.

Addressing claim 33, for the additional limitations of this claim see Squires Figures 1, 2, 7, 9, 10, 12, and 13.

Addressing claim 69, Squires discloses a method for pumping fluid in a microchannel comprising the sep of applying an electric field to a conducive member in the microchannel sufficient to cause fluid in the microchannel to flow. See the title and Figures 7, 9, 10, 12, and 13. Squires does not mention whether “secondary” electrosmosis is produced. However, this limitation is anticipated because, first, Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196), which was provided by Applicant in their last Information Disclosure Statement, states

> The main difference between usual electrokinetic phenomena (i.e., electrokinetic phenomena of the first kind) and those of the second kind is that in the former the permanent surface charge is responsible, whereas in the latter [secondary electroosmosis] it is bulk charge, induced by the applied field itself. [emphasis added] *See the top of page 174.*

That is, according to Dukhin induced-charge electroosmosis is secondary electrosmosis. Similarly, an article by Bazant appears to suggest that secondary electroosmosis is a special type of induced-charge electroosmosis. Note especially “A

super-limiting current causes the formation of extended <u>*space charge*</u>, which can alter the nature of ICEO flow.[emphasis added]" See the section entitled *Electrokinetic phenomena of the second kind* in the Bazant article.

Second, secondary electrosmosis and induced-charge electroosmosis are not incompatible. Applicant's own specification states, "Classical electroosmosis (EO1) is caused by transport of permanent charges (ions) in the EDL ... It is important that the SCR is established independently of the presence of any EDL on the surface." See page 18 of the specification. So, induced charge electroosmosis may be accompanied by secondary electroosmosis.

Addressing claim 70, for the additional limitation of this claim see *E. Asymmetric Conductors* on page 5 of Squires , bridging to page 6.

Addressing claim 71, the additional limitation of this claim is implied by the first paragraph on page 5 of Bazant (first paragraph in "Electrokinetic phenomena of the second kind"). One with ordinary skill in the art would expect that since a steady DC voltage, which is necessarily of one polarity, will cause secondary electroosmosis because of a change in bulk salt concentration, than the opposite polarity should be not cause secondary electroosomosis.

Addressing claim 72, one with ordinary skill in the art would expect, in light of the Bazant passage referred to in the rejection of claim 71, that the reverse polarity field will

have to be applied for the same time as the original filed so as to restore the salt concentration gradient to the original value.

Addressing claim 73, for the additional limitation of this claim see the first paragraph in Squires.

5. Claims 32, 69, and 73 are rejected under 35 U.S.C. 102(b) as being anticipated by Theeuwes US 4,540,403 ("Theeuwes") as evidenced by MIschuk ("Electro-osmosis of the second kind near heterogeneous ion-exchange membrane," Colloids and Surfaces A: Physicochemical and Engineering Aspects 140 (1998) 75-89) ("Mischuk").

Addressing claim 32, Theeuwes discloses a microfluidic system comprising a microchannel and a pump arranged to electrosmotically cause flow. See the abstract; Figures 1-5; col. 06:09-11; and col. 03:63-67. Theeuwes does not mention whether the fluid flow is at least in part due to secondary electroosmosis. However this appears to be an intended use of which the pump in Theeuwes is capable. Moreover, in light of Mischuk the pumping in Theeuwes is inherently secondary electroosmsosis as the pump in Theewues may comprise ion exchange material. See Theewues col. 03:51-63; and the abstract; and Mischuk the first full paragraph in the second column on page 76.

For claim 73 note that the Examiner broadly construes microchannel to a channel having a dimension on the order of microns.

Addressing claim 69, Theeuwes discloses a method for pumping fluid in a microchannel comprising the sep of applying an electric field to a conducive member in the microchannel sufficient to cause fluid in the microchannel to flow. See the abstract; Figures 1-5; col. 06:09-11; and col. 03:63-67. Theeuwes does not mention whether the fluid flow is at least in part due to secondary electroosmosis. However this appears to be an intended use of which the pump in Theeuwes is capable. Moreover, in light of Mischuk the pumping in Theeuwes is inherently secondary electroosmosis as the pump in Theewues may comprise ion exchange material. See Theewues col. 03:51-63; and the abstract; and Mischuk the first full paragraph in the second column on page 76.

Claim Rejections - 35 USC § 103

6. Claims 34-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Squires, ("Microfluidic Pumps and Mixers Driven by Induced-Charge Electro-osmosis") as evidenced by Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196) and Bazant (Nonlinear electrokinetic phenomena, M. Z. Bazant, in Li, Dongqing (ed), *Encyclopedia of Microfluidics and Nanofluidics*, Part 14, pp. 1461-1470 (Springer,

Berlin, Heidelberg, New York, 2008), downloaded from

www.stanford.edu/group/bazant/papers on December 09, 2008).

Addressing claim 34, Squires discloses a microfluidic system comprising a microchannel and a pump arranged to cause fluid to flow under the action of electroosmosis. See the title and Figures 7, 9, 10, 12, and 13. Squires does not mention whether “secondary” electrosmosis is produced. However, this limitation is anticipated because, first, Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196), which was provided by Applicant in their last Information Disclosure Statement, states

> The main difference between usual electrokinetic phenomena (i.e., electrokinetic phenomena of the first kind) and those of the second kind is that in the former the permanent surface charge is responsible, whereas in the latter [secondary electroosmosis] it is bulk charge, induced by the applied field itself. [emphasis added] *See the top of page 174.*

That is, according to Dukhin induced-charge electroosmosis is secondary electrosmosis. Similarly, an article by Bazant appears to suggest that secondary electroosmosis is a special type of induced-charge electroosmosis. Note especially “A super-limiting current causes the formation of extended *space charge*, which can alter the nature of ICEO flow.[emphasis added]” See the section entitled *Electrokinetic phenomena of the second kind* in the Bazant article.

Second, secondary electrosmosis and induced-charge electroosmosis are not incompatible. Applicant’s own specification states, “Classical electroosmosis (EO1) is caused by transport of permanent charges (ions) in the EDL ... It is important that the SCR is established independently of the presence of any EDL on the surface." See

page 18 of the specification. So, induced charge electroosmosis may be accompanied by secondary electroosmosis.

Last, claim 32 is an apparatus claim. That Applicant's apparatus (microfluidic system) is used to create flow under the action of secondary electrosmosis is an intended use of which the apparatus of Squires is capable. The necessary structure for the microfluidic system appears to be only conducting elements projecting into the microchannel and a power supply to create an electrical field across the conducting elements. See "The conditions for obtaining EO2 can be summarized:" on page 20 of Applicant's specification. There is a strong similarity, for example, between Applicant's Figures 8-11 and Squires Figures 7, 9, 10, 12, and 13.

Squires further discloses the pump having at least one electrically conducive member as set forth in claim 33. See Squires Figures 1, 2, 7, 9, 10, 12, and 13.

Squires does not mention whether the space between the electrically conductive member and the walls of the microchannel is between 0 a_{char} and 2 a_{char} and whether the surface of at least one electrically conductive member is smooth such that the surface irregularities are less than 5% of d_{char}. As for the limitation regarding the space between the electrically conductive member and the walls of the microchannel Squires does show the field lines between an electrically conductive member and the wall of a microchannel in the context of optimizing geometries for junction pumps. See "III. Microfluidic Pumps and Mixers – A. Junction Pumps" on page 6, bridging page 7. In the same passage Squires also shows a graph of flow rate versus the ratio of cylinder radius to the channel width. Thus, recognizes that the space between the electrically

conductive member and the walls of the microchannel will affect the pumping effect of the electrically conductive member. So, barring a contrary showing, in light of Squires the limitation regarding the space between the electrically conductive member and the walls of the microchannel being between 0 a_{char} and 2 a_{char} is just optimization for a desired pumping effect. Similarly, in regard the limitation regarding surface irregularities, Squires discloses how asymmetry of and dielectric coating on the electrically conductive member will affect pumping. See “E. Asymmetric Conductors” on page 5, bridging to page 6. So this limitation is also just optimization for a desired pumping effect.

Addressing claim 35, as argued against claim 34 barring a contrary showing in light of the teaching of Squires limitations regarding the space between the electrically conducing member and the channel walls and surface irregularities are just optimization for a desired pumping effect.

Addressing claim 36, for the additional limitation of this claim see Squires Figures 6, 9, and 12.

Addressing claim 37, for the additional limitation of this claim see Squires Figures 6, 9, and 12.

Addressing claim 38, for the additional limitation of this claim see Squires Figure 12.

Addressing claims 39 and 40, Squires does not mention whether the particle constituting the electrically conducting member has a size of 0.1 μm – 5 mm or 1.0 μm to 500 μm measured in parallel to the externally imposed electric field. However, Squires does recognize that the electrode osmotic felid will be affected by the size of the electrically conducting member and does disclose a 1 μm radius for a cylindrical electrically conducting member. See Figure 1 caption and the first full paragraph in the second column on page 3. So in light of this disclosure in Squires to use an electrically

conducting member having a size of 0.1 μm – 5 mm or 1.0 μm to 500 μm measured in parallel to the externally imposed electric field is just optimization of the size and shape of the electrically conducting member for a desired pumping effect.

Addressing claims 41 and 42, the additional limitations of these claims are suggested by Figure 12 in Squires. Also note Figure 6(d).

Addressing claim 43, for the additional limitation of this claim see Squires Figures 12 and 13, which are only illustrative of the concept of providing several layers of conducting particle. Providing more layers than shown is an obvious variant to achieve or optimize the desired pumping effect.

Addressing claim 44, for the additional limitation of this claim see Squires Figure 8, which shows ions adsorbed to the electrically conducting material.

Addressing claim 45, for the additional limitation of this claim note that the Examiner understands "electrically conducting material" to be the same as "electronically conducting material." In ay event, Squires discloses that the conducting material may be metallic wires. See the bottom of the first column on page 7, bridging to the second column.

Addressing claims 47 and 48, for the additional limitations of these claims note that the electrical conducting member in Squires may be a metal wire and the fluid may be bodily fluid, such as blood or lymph or an aqueous electrolyte solution. See the first column on the first page of Squires and the end of the first column on page 7 of Squires.

Addressing claim 49, for the additional limitation of this claim note that a pair of electrodes as claimed is implied since by the electrical field lines shown in Squires Figures 1 and 7, for example.

Addressing claim 50, for the additional limitation of this claim see Squires Figure 7.

Addressing claim 51, for the additional limitation of this claim see *B. Weak AC Fields* and *C. Strong DC or AC Fields* on page 5 of Squires.

Addressing claim 52, for the additional limitation of this claim see *B. Weak AC Fields* on page 5 of Squires, which discloses at least an alternating field having a sine shape.

Addressing claims 53-57, for the additional limitations of these claims note that although Squires does not specifically mention the particular fields recited Squires does

disclose using a DC field or an AC field. See *B. Weak AC Fields* and *C. Strong DC or AC Fields* on page 5 of Squires. So, barring a contrary showing, the particular fields claimed are just a matter of optimizing the electrical field for desired pumping effects.

Addressing claim 58, for the additional limitation of this claim see A*. Weak DC Fields* on page 3 and *C. Strong DC or AC Fields* on page 5 of Squires.

Addressing claim 59, for the additional limitation of this claim note that although Squires does not specifically mention whether any the electrical connection means is a distance of between 01. and 5 mm to the electrically conducing member this is implied as the configures of the electrodes and electrically conducing members shown in Figures 7, 9, 11, 12, 13, and 14 are in or on microfluid channels, that is, channels with a diameter on the order of microns.

Addressing claim 60, for the additional limitation of this claim note the four electrodes shown in Squires Figures 10, 12, 13, and 14. How the claimed electrodes are to be used is an intended use that does patentably distinguish them from those of Squires.

Addressing claim 61, for the additional limitations of this claim note the four electrodes shown in Squires Figures 10, 12, 13, and 14.

Addressing claim 62, for the additional limitations of this claim see the first paragraph of *A. Junction Pumps* on page 6, which discloses that the electric field applied to the two pairs of electrodes may be DC or AC and may have opposite polarities (thus be out of phase).

Addressing claim 63, for the additional limitations of this claim see Figure 6(d) and Figures 12 and 14.

Addressing claim 64, for the additional limitations of this claim see *A. Junction Pumps*, which begins on page 6 of Squires *D. Linear-Channel Hybrid Pump-Mixers*, which begins on page 8.

Addressing claim 65, for the additional limitations of this claim see *B. Mixers*, which begins on page 7 of Squires, and *D. Linear-Channel Hybrid Pump-Mixers*, which begins on page 8.

Addressing claims 64-67, for the additional limitations of these claims see the first paragraph of Squires.

7. Claim 66 is rejected under 35 U.S.C. 103(a) as being unpatentable over Theeuwes US 4,540,403 ("Theeuwes") as evidenced by MIschuk ("Electro-osmosis of the second kind near heterogeneous ion-exchange membrane," Colloids and Surfaces A: Physicochemical and Engineering Aspects 140 (1998) 75-89) ("Mischuk") in view of Squires, ("Microfluidic Pumps and Mixers Driven by Induced-Charge Electro-osmosis") as evidenced by Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196) and Bazant (Nonlinear electrokinetic phenomena, M. Z. Bazant, in Li, Dongqing (ed), *Encyclopedia of Microfluidics and Nanofluidics*, Part 14, pp. 1461-1470 (Springer, Berlin, Heidelberg, New York, 2008), downloaded from www.stanford.edu/group/bazant/papers on December 09, 2008).

Theeuwes discloses a microfluidic system comprising a microchannnel and a pump arranged to electrosmotically cause flow. See the abstract; Figures 1-5; col. 06:09-11; and col. 03:63-67. Theeuwes does not mention whether the fluid flow is at least in part due to secondary electroosmosis. As a first matter this appears to be an intended use of which the pump in Theeuwes is capable if it is not inherent as the pump may comprise ion exchange material. See col. 03:51-63; the abstract; and the first full paragraph in the second column on page 76 of Mischuk.

If somehow it can be established that the pumping in Theeuwes does not involve secondary electroosmosis then it should be noted that Squires discloses a microfluidic

system comprising a microchannel and a pump arranged to cause fluid to flow under the action of electroosmosis. See the title and Figures 7, 9, 10, 12, and 13. Squires does not mention whether “secondary” electrosmosis is produced. However, this limitation is anticipated because, first, Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196), which was provided by Applicant in their last Information Disclosure Statement, states

> The main difference between usual electrokinetic phenomena (i.e., electrokinetic phenomena of the first kind) and those of the second kind is that in the former the permanent surface charge is responsible, whereas in the latter [secondary electroosmosis] it is bulk charge, induced by the applied field itself. [emphasis added] *See the top of page 174.*

That is, according to Dukhin induced-charge electroosmosis is secondary electrosmosis. Similarly, an article by Bazant appears to suggest that secondary electroosmosis is a special type of induced-charge electroosmosis. Note especially “A super-limiting current causes the formation of extended *space charge*, which can alter the nature of ICEO flow.[emphasis added]” See the section entitled *Electrokinetic phenomena of the second kind* in the Bazant article.

Second, secondary electrosmosis and induced-charge electroosmosis are not incompatible. Applicant’s own specification states, “Classical electroosmosis (EO1) is caused by transport of permanent charges (ions) in the EDL ... It is important that the SCR is established independently of the presence of any EDL on the surface." See page 18 of the specification. So, induced charge electroosmosis may be accompanied by secondary electroosmosis.

Last, claim 32 is an apparatus claim. That Applicant's apparatus (microfluidic system) is used to create flow under the action of secondary electrosmosis is an intended use of which the apparatus of Squires is capable. The necessary structure for the microfluidic system appears to be only conducting elements projecting into the microchannel and a power supply to create an electrical field across the conducting elements. See "The conditions for obtaining EO2 can be summarized:" on page 20 of Applicant's specification. There is a strong similarity, for example, between Applicant's Figures 8-11 and Squires Figures 7, 9, 10, 12, and 13.

It would have been obvious to one with ordinary skill in the art at the time of the invention to use a pump as taught by Squires in the invention of Theeuwes because as taught by Squires their pump avoids several problems of conventional electrosmotic pumps, such as anode dissolution, deposition of ions at the cathode, and electrolyte concentration gradients. Also, the pumps can be made smaller, safer, and more reliable. See the second column of page 1 of Squires, bridging to page 3.

8. Claim 68 is rejected under 35 U.S.C. 103(a) as being unpatentable over Squires, (“Microfluidic Pumps and Mixers Driven by Induced-Charge Electro-osmosis”) as evidenced by Dukhin (Advances in Colloid and Interface Science 85 (1991) 173-196) and Bazant (Nonlinear electrokinetic phenomena, M. Z. Bazant, in Li, Dongqing (ed), *Encyclopedia of Microfluidics and Nanofluidics*, Part 14, pp. 1461-1470 (Springer, Berlin, Heidelberg, New York, 2008), downloaded from www.stanford.edu/group/bazant/papers on December 09, 2008) as applied to claims 34-65 above, and further in view of Goodson et al. US 6,942,018 B2 (‘Goodson”).

Squires does not specifically mention arranging the system to provide electronics cooling. However, clearly a wide range of applications for the system is contemplated. See the first paragraph of Squires. Goodson discloses using an electro-osmotic pump for electronics cooling. See the abstract and col. 01:10-18. So in light of Goodson to use the micropump of Squires for electronics cooling is simple substitution of one known element for another (Squires' pump for Goodson's) to obtain predictable results (the benefits over conventional electroosmotic pumps disclosed by Squires in the second column on page 1, bridging to page 2) or just a matter of applying a known technique (Squire's pumping) to a known device (Goodson's) to yield predictable results (the benefits over conventional electroosmotic pumps disclosed by Squires in the second column on page 1, bridging to page 2).

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 36, 46, and 59 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention:

a) Claim 36 - Bread can have various shapes. It is not clear what a pone-shaped conductor will look like.

THE FREE DICTIONARY

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Legal dictionary | Encyclopedia | Wikipedia encyclopedia

pone Also found in: Legal, Encyclopedia, Wikipedia

pone (pōn)
n. Chiefly Southern U.S.
See johnnycake. See Regional Notes at johnnycake, light bread.

[Virginia Algonquian poan, appoans, *cornbread.*]

Regional Note: A staple of the early American colonies from New England southward to Virginia was *pone,* a bread made by Native Americans from flat cakes of cornmeal dough baked in ashes. *Pone* is one of several Virginia Algonquian words (including *hominy* and *tomahawk*) borrowed into the English of the Atlantic seaboard. The word *pone,* usually in the compound *cornpone,* is now used mainly in the South, where it means cakes of cornbread baked on a griddle or in hot ashes—as the Native Americans originally cooked it.

Thesaurus **Legend:** Synonyms Related Words Antonyms

Noun 1. pone - cornbread often made without milk or eggs and baked or fried (southern)
cornpone
cornbread - bread made primarily of cornmeal

b) Claim 46: the scope of “hole conducting material” is not clear.

c) Claim 59 recites the limitation "electrical connection means" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Allowable Subject Matter

11. Claim 46 would be allowable if rewritten to overcome the rejection under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

a) Claim 46: to the extent that this claim refers to an electric charge carrier with a positive charge equal in magnitude, but opposite in polarity to the charge on the electron such is not taught by Squires. This limitation implies a semiconductor material. In Squires the electrically conducting materials are metal objects, such as wires or metal strips, or metallic or metallic and dielectric coatings on metal objects.

Final Rejection

12. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

/Alex Noguerola/

Primary Examiner, Art Unit 1795

December 11, 2008